

<Print title of the experiment >

<Print the proposed work category, i.e., experiment or non>

ANLHEP_644

Date of Submission 6/16/08 ☒ New ☐ Renewal ☐ Supplemental Change

Your Name: Sergey Antipov				
Project Title: Evaporation system for polysterene-toluene mixtures				
Location, building/Room, etc.			BLD 366, HOOD	
Project dates:	Start:	8/16/08	End:	8/16/09
Designated Project Manager:			Sergey Antipov	

The Project Manager / Principle Investigator must be familiar with the responsibilities and the requirements of the experiment safety review in the *ESH Manual*, Section 21.2.

Work may not be performed until procedures have been approved, and authorization is granted. This completed form, hazard analysis and all supporting documentation must be submitted to the division ES&H Coordinator. Appropriate personnel for ES&H issues associated with the proposed work will review the information. The Project Manager must resolve outstanding issues before the work begins; no work may begin until Approval and Authorization is granted.

Project Manager Approval

8/8/08
Date

Richard Konecny
Review Approval

7-09-08
Date

[Signature]
ES&H Authorization

8/8/08
Date

Division Authorization

Date

SCOPE OF WORK (ISM STEP 1)

General Description

Provide a general overview description of the experiment (or non-experimental work project). Describe specific equipment for tasks within the project, concentrate on operations that focus on the work, and summarize the hazards that you expect to encounter. Attach designs, drawings, or other useful descriptive material.

The evaporation system for polystyrene-toluene mixtures is being built.

Polystyrene-toluene mixture is provided by CSE (Dr Oleg Poluektov).

The goal is to evaporate toluene under vacuum.

Toluene volume is small: 50 ml max.

The setup consists of the following:

1. Bell jar. It is a 1 gallon thick glass jar that will be pumped to low vacuum 5×10^{-2} Torr. (For comparison AWA beamline is under $\sim 1 \times 10^{-10}$ Torr).
2. Roughing pump. It is a standard pump used for low pressure applications.
3. Heat tape. It is a standard tool to heat objects to up to 150 C. It operates via a controller from 110 V outlet. In the setup the heat tape will be heating the polystyrene-toluene mixture from 35 C to a maximum 100 C.

There will be a hose connected to the pump exhaust that will guide the evaporating toluene into the hood (bld 362).

There are three hazards that are expected:

1. Toluene.

Toluene is rated 3 in flammability risk (NFPA 704).

Evaporation in vacuum eliminates this risk.

Toluene is rated 2 in health risk.

To address this issue I use a hose, that guides the toluene from the pump exhaust into the hood (bld 366).

This way the risk is eliminated.

2. The hazard of the Bell jar implosion.

Pumping vacuum on a glass jar creates a risk of implosion.

The jar will be placed into the hood behind protective barrier.

3. Electrical hazard.

Heat tape requires electricity that will be supplied using feedthroughs.

There is a risk of a wire shorting out on the Bell jar base.

To eliminate the risk the base is grounded.

HAZARD ANALYSIS (ISM STEP 2)

Hazard List

Examples include but are not limited to the examples below. You may expand your comments on hazard analysis in the scope of work (ISM STEP 1) section of this document.

Low Risk

- ☐ Delivery of items such as furniture, office supplies
- ☐ Equipment (bench top set up) utilizing hand tools and that does not fall into another hazard classification
- ☐ Equipment repair, de-energized, utilizing hand tools, and that does not fall into another hazard classification
- X Equipment calibration, de-energized, utilizing hand tools, and that does not fall into another hazard classification
- ☐ Computer set-up
- ☐ Installation of window blinds that requires no power tools or use of a ladder
- ☐ Performing office-type tasks
- X Assembly of technical components with use of hand tools and no exposure to additional hazards of a greater risk

Moderate Risk

- ☐ Installation of furniture utilizing power tools, battery operated tools or hand tools
- ☐ Installation of office partitions, including repair and modification to existing partitions, shelving involving no hard wiring of electrical connections, plug type only
- ☐ Installations of carpet with or without utilizing consumer quantity of adhesive product
- ☐ Low voltage calibration/testing. Below 50 volts
- ☐ Repair and/or window glass replacement, window cleaning below 6 ft.
- ☐ Repairs that do not require lockout/tagout or use of chemicals that are above a consumer commodity quantity
- ☐ Kitchen appliance repair with out any additional exposure to a high risk activity
- ☐ Activity that does not involve working with any type of energy source, working above 6 ft., or entry into a confined space
- ☐ Painting with latex paint
- ☐ Site survey work that is not within 6 feet of a roadway and does not include the use of lasers higher than class 2
- ☐ Tree and flower planting in pots or planters

- ☐ Use of class 2 lasers
- ☐ Assembly of technical components utilizing power tools, battery operated tools, or hand tools
- ☐ Assembly of purchased component utilizing power tools, battery operated tools, or hand tools
- X Service of experimental mechanical devices utilizing power tools, battery operated tools, or hand tools
- ☐ Installation of wire cages utilizing power tools, battery operated tools, or hand tools

High Risk

- ☐ Electrical or other energy sources requiring lockout/tagout for any installation or modification
- ☐ Working with or having an exposure to hazardous materials (e.g., toxins, carcinogens, asbestos, lead, beryllium, etc.)
- ☐ Excavations of any type or depth that requires a Dig Permit
- ☐ Confined spaces
- ☐ Noise levels above 85 dB
- ☐ Ionizing radiation (per entry posting)
- ☐ Non-ionizing radiation (per entry posting)
- ☐ Working on energized equipment of greater than 50 volts
- ☐ Installation of office partitions containing electrical hard wire electrical connections
- ☐ Activity requiring lockout/tagout of energy source
- ☐ Work on transformer
- ☐ Working with the potential for a fall from a height greater than 6 ft
- ☐ Pole work of any nature
- ☐ Communication tower work including erecting, painting, or inspection
- ☐ Elevator repair/maintenance/inspection
- ☐ Overhead crane inspections or repair
- ☐ Equipment alignment of energized equipment
- ☐ Sprinkler repairs or modifications
- ☐ Utility line work on gas line, electrical, water, steam, air, or communication
- ☐ Mechanical work that may include welding, cutting, burning, or any open flame work, metal grinding, or saw cutting
- ☐ Concrete boring/cutting/grinding/jack hammering
- ☐ Hoisting, rigging, or lifting
- ☐ Parking lot paving and striping

- ☐ Tree and stump removal, grass burning, or chemical treatments
- ☐ Laser repair and installation
- ☐ Painting with epoxy paint
- ☐ Chiller or refrigerant repair/recovery or replacement
- X Chemical use (use of flammable products, asbestos abatement, work on lead painted surfaces)
- ☐ Potential releases to environmental media (air, land, surface water, and/or groundwater)
- ☐ Equipment use (cranes, fork lift, scissor lift, boom lift, scaffolds, back hoes, bobcats)
- ☐ Other high risk situations as determined by line management or the division ES&H coordinator

Yes No

✓ ☐ **Is this job performed in a location or environment having a special designation where specific precautions are to be observed?**

Examples (Check those applicable)

- ☐ Nuclear facility
- ☐ Nonnuclear radiological facility
- ☐ Radiological controlled area
- ☐ Outdoor-NEPA review
- X Indoor-laboratory, service area, common area
- ☐ Floor loading limitations
- ☐ Noise posted area
- ☐ Laser controlled area
- ☐ Biohazard area
- ☐ Magnetic field
- ☐ Ultraviolet (UV)
- ☐ Microware
- ☐ High heat/cryogenics
- ☐ Hazardous/flammable/reactive chemicals
- ☐ Energized electrical, pressure system
- ☐ Confined space

- ☐ Elevated 6 feet or more above working level
- ☐ Asbestos, lead, mercury, beryllium in area or could be disturbed
- ☐ Clean room
- ☐ Other specifically defined locations or environments?

Yes No

☒ **Is this job a complex activity?**

Examples (Check those applicable)

- ☐ More than one work group necessary to complete the job.
- ☐ Steps of a task or tasks of a job must be completed in an exact sequence.
- ☐ Shutdowns of various systems and lockout/tagouts of various energy sources must be completed.
- ☐ Life safety features/egress routes altered.
- ☐ Additional specific training/skills/knowledge/fitness required for those performing task.
- ☐ Materials handling issues - heavy, bulky, hazardous materials handled individually, with manually operated equipment with powered equipment such as forklifts, cranes, etc.
- ☐ Other specific complex activities? You may expand your comments in the scope of work (ISM STEP 1) section of this document.

HAZARD CONTROLS (ISM STEP 3)

ENGINEERING CONTROLS

Describe the engineering controls applied to control the hazards. Engineering controls include enclosures and barriers that cannot be removed without the use of tools, interlocks, ventilation, software controls, etc.

Task	Engineering Controls
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Controlling the evaporation temperature using electrically powered heat tape	The base of the evaporating system is grounded. This eliminates the hazard of the heat tape wire shorting a bell jar base
Controlling the vacuum pressure inside the bell jar	The bell jar is placed in the hood behind the protective barrier. This eliminates the risk of jar implosion
Controlling the evaporation process	The exhaust from the pump contains toluene. The hose is attached to the pump outlet to guide the toluene into the hood

ADMINISTRATIVE CONTROLS

List all work procedures, permits and checklists necessary to mitigate hazards. The Project Manager must describe where skill of the researcher/craft/work is being relied upon for hazard mitigation and control.

Task	Administrative Controls
Operation of the evaporating system	The evaporating system can be operated by authorized personnel only. The person, providing he has the skills to operate the system can be authorized by project manager after having an on the job site training.

PERSONAL PROTECTIVE EQUIPMENT

Specify personal protective equipment (PPE) to be worn. For gloves, be specific as to the type appropriate for the task and which steps in the activity the PPE is required.

Task	PPE
Operation of the system	The operator must have safety goggles. The operator can not wear shorts or an open-toe shoes

WORKING WITHIN CONTROLS (ISM STEP 4)

All work must be performed within the controls for all the identified hazards.

It is the Project Manager responsibility to verify that this document is kept up to date and determine if changes are significant enough to require a new review/document.

FEEDBACK (ISM STEP 5)

Identify types of records and the reporting method that is useful for improvement on the tasks within this project. This could include lab notebooks, datasheets, computer data, instrument logs, images, etc.

Task/Situation	Record
Emergency	Call 911, take appropriate immediate action (e.g., evacuate space) notify supervisor, building manager, division management, ESH coordinator
Experimental procedure	All experimental procedures will be recorded in the lab book

Was a graded an approach applied to identify the hazards described in the scope of work? As an example, did a knowledgeable colleague who will neither supervise nor perform the experiment review the proposal, examine the setup then document his or her conclusions in accordance with implementing ISM appropriate for work approval/authorization? X Yes ☐ No

If yes, describe the graded approach taken.

I discussed the details of the electrical and mechanical part of the setup design with Richard Konecny, a senior engineer at the AWA. I received a feedback and applied controls to eliminate implosion hazard and the electrical hazard.

I talked over the procedure of Toluene evaporation with Dr. Oleg Poluektov from Chemical Sciences and Engineering Division. Based on his suggestions I limited the size of the sample (50 ml Toluene - maximum) to eliminate fire hazard and implemented an engineering control to eliminate health hazard of Toluene.

I talked to HEP ESH administrator. Based on his feedback, I added administrative controls to make sure, that the operator has the correct training before operating the evaporation system.

